

VISCOSITY REDUCTION PROCESS OF HYDROXY PROPYL METHYL CELLULOSE

VIVEK KRISHNAMOORTHY

Consultant, Prompt Pvt. Ltd, Ellora, Chhedanagar, Mumbai, Maharashtra, India

ABSTRACT

This paper introduces the scheme to reduce Hydroxy Propyl Methyl Cellulose (HPMC) of high viscosity ~ 4 Pascal. Second to low viscosity ~ 0.004 Pascal. Second. The application involved was in the manufacture of raw material HPMC for capsule manufacturing. The process parameters considered for the viscosity reduction process were quantity of feed, batch cycle time, temperature of the operation and quantity of HCl gas. After optimization of these process parameters, HPMC of ~4 Pascal. Second was reduced to HPMC of ~0.004 Pascal. Second.

KEYWORDS: Cellulose, HPMC, Viscosity

INTRODUCTION

HPMC of different chemistries has been used in various applications like pharma, food and construction. It is typically synthesized by using methyl chloride, propylene oxide, sodium hydroxide and an ether. The high molecular weight HPMC is then reduced to lower molecular weight HPMC by the viscosity degradation process.

UNITS

% solution indicated weight%

Pascal Second – Indicates unit of viscosity

DESCRIPTION OF THE PROCESS

It has been reported in literature the usage of HCl gas for viscosity reduction of HPMC. Research was undertaken to understand the process parameter interaction and effects of each parameter individually in the process. A gas collection vessel of S.S. make, free from moisture was weighed. HCl gas was collected at a suitable pressure from the gas cylinder by adjusting the regulator. The gas collected in the collection vessel was weighed. In this way different quantity of HCl gas was collected. Nitrogen purging was carried out in the cone blender to remove oxygen. HPMC of 4 Pascal. Second was added to the double cone blender through a funnel. HCl gas was transferred from the collection vessel to the double cone blender. The temperature of the double cone blender was set. It was observed that the colour of the viscosity – reduced HPMC powder was controlled by temperature. When temperature was increased, the viscosity degraded to a greater extent for the same batch cycle time and HCl quantity. When different HCl gas quantities were added for the same temperature and batch viscosity reduced with increasing quantity of HCl gas. When different batch times were introduced for a given temperature and quantity of HCl gas, the viscosity degraded with increasing batch cycle time. SS make was required for most of the equipments. The area was ventilated to allow the passage of HCl gas. Low temperature operation reduced the utility, cost, time and viscosity of HPMC. Reduction of batch cycle time enhanced production of greater number of batches

HPMC powder was prepared to observe the colour. 2% solution of the viscosity-reduced HPMC solution was prepared to measure the viscosity in a Brookfield viscometer. The maximum batch cycle time involved was 4.5 hrs and the minimum was 1.5 hrs. The maximum quantity of HCl gas utilized was 10 gm and minimum of 3.8 gm. The minimum temperature utilized was 48C and maximum was 70C. Feed ratio of HPMC 4 Pascal. Second powder to quantity of HCl gas was varied from 250:1 to 100:1. The 20% solution of viscosity- reduced HPMC was kept in an ice bath. The 2% solution of viscosity-reduced HPMC was adjusted to the temperature of Brookfield Viscometer. Different viscosities were obtained for the combination of batch cycle time, temperature of operation and quantity of HCl gas. The target of 0.004 Pascal. Second viscosity was easily obtained by the described scheme.

OTHER RECOMMENDATIONS

Moisture content of HPMC of 4 Pascal. Second can be obtained through moisture determining apparatus. It may play a role in the viscosity reduction process. Tests are advised to ascertain the role of moisture content in the degradation process. Salts like sodium bicarbonate or sodium carbonate can be utilized to neutralize HCl in the viscosity – reduced HPMC powder batches. 20% solutions of some grades of HPMC 4 Pascal. Second after the degradation process developed microbial activity on a long storage time. Viscosity – reduced HPMC powders degraded further when stored in hot weather conditions. The pH of the 2% solution can be measured to identify the acidity content of viscosity-reduced HPMC solutions. The 2% solution of viscosity-reduced HPMC solution should be clear in nature.

CONCLUSIONS

It is possible to reduce the viscosity of high cps HPMC powders to low viscosities. Application and usage of and quantity of HCl gas played a definite role in the viscosity degradation process. This process reduces the risk exposed when hydrogen peroxide is utilized compared to HCl. Process parameters are instrumental in deciding the end viscosity.

REFERENCES

1. Ebenezer, E. R. (1932) Process for reducing the viscosity of cellulose ethers
2. Callahan, M. (1930) Method of reducing the solution viscosity of cellulose. US patent 1904406
3. Richard, F, Martin, R. (1939) Making low viscosity cellulose ethers. US patent 2159377
4. Eugene, K. (1947) Preparation of cellulose ethers. US patent 2512338
5. Eugene, K. (1950) Preparation of cellulose ethers. US patent 2523377
6. Hans, C, Carl, M. (1939) Preparation of cellulose ethers. US patent 2170009
7. Callihan, C. (1968) Dissolution of cellulose ethers. US patent 3376285
8. Dow Chemical Company, Methocel cellulose ethers: Technical handbook
9. Traill, D. (1933) Manufacture of alkyl ethers of cellulose. US patent 1938360
10. Dumitriu, S. (1996) Polysaccharides in medicinal applications. pp. 102-105
11. Bikales, N. M, Segal, L. (1971) Cellulose and cellulose derivatives. Vol. 5, Wiley – Interscience, New York
12. Savage (1973) Process for reducing the viscosity of cellulose ether with Hydrogen Peroxide. US patent 3728331

13. Richard, F, Martin, R. Making low viscosity cellulose ethers. US patent 1864554, US patent 2159375
14. Holst, A. (1982) Process for reducing viscosity of cellulose ethers by means of ozone and application thereof. US patent 4316982 a
15. Pelzer, H. (1990) Process for the preparation of low viscosity cellulose ethers. US patent 4894448
16. Cheng, W, J. (1977) Sulphur Dioxide. US Patent 4061859

